



Evaluation #

200437-N  
(Replaces 990040-N)

Safety & Buildings Division  
201 West Washington Avenue  
P.O. Box 2658  
Madison, WI 53701-2658

## Wisconsin Building Products Evaluation

Material

Truss Connector Plates  
Model 20, TW18, and TW16

Manufacturer

Truswal Systems Corporation  
1101 N. GSW Pkwy.  
Arlington, TX 76011

### SCOPE OF EVALUATION

**GENERAL:** This report evaluates Model 20 (20 gauge), TW18 (18 gauge) and TW16 (16 gauge) metal connector plates for wood trusses, manufactured by Truswal Systems Corporation.

The **Comm** requirements below in accordance with the current **Wisconsin Uniform Dwelling Code for 1 & 2 family dwellings**:

- **Allowable Stress Design:** Model 20 (20 gauge), TW18 (18 gauge) and TW16 (16 gauge) metal connector plates for wood trusses, were evaluated for use within allowable design values in accordance with **s. Comm 21.02(3)** and standards adopted under **s. Comm 20.24, Table 20.24-12**.

The **IBC** requirements below in accordance with the current **Wisconsin Amended ICC Code**:

- **Allowable Stress Design:** Model 20 (20 gauge), TW18 (18 gauge) and TW16 (16 gauge) metal connector plates wood trusses were evaluated for use within allowable design values in accordance with **s. IBC 2306.1** and **s. IBC 2308.10.7.1**.

### DESCRIPTION AND USE

**Model 20 and TW18:** Model 20 truss connector plates are manufactured from 20-gauge structural quality galvanized steel that meets or exceeds ASTM A653/A653M. TW18 truss connector plates are manufactured from 18-gauge structural quality galvanized steel that meets or exceeds ASTM A653/A653M. Slots, approximately 7/16-inch in length, are punched along the longitudinal axis of the plate, each punch forming two opposite-facing, sharply-pointed teeth protruding at right angles from the parent metal. The punches are spaced approximately 1/4-inch on center across the width of the plate and approximately 1-inch on center along the length of the plate with adjacent longitudinal rows staggered approximately 1/8-inch. There are eight teeth per square inch of plate surface area. Each tooth is

approximately 3/8-inch (including the plate thickness) and is approximately 1/8-inch in width. The shank of each tooth is formed into a slightly concave shape and is twisted along the length of the tooth shank so that the end of the tooth is rotated to approximately 35 degrees with respect to the plate width. Adjacent longitudinal rows of teeth are twisted in opposite directions. Connector plates are available in one-inch increments of width and length.

**NOTE:** Model 20 and TW18 connector plates are identical except for the steel thickness. Therefore, the tension and shear effectiveness ratios and lateral resistance values for the TW18 connector plates are the same as those for the Model 20 connector plates.

**TW16:** TW16 truss connector plates are manufactured from 16-gauge structural quality galvanized steel that meets or exceeds ASTM A653/A653M. Slots, approximately 1/2-inch in length, are punched along the longitudinal axis of the plate, each punch forming two opposite-facing, sharply-pointed teeth protruding at right angles from the parent metal. The punches are spaced approximately 1/3-inch on center across the width of the plate and approximately 1-1/4-inch on center along the length of the plate with adjacent longitudinal rows staggered approximately 5/8-inch. There are 4.8 teeth per square inch of plate surface area. Each tooth is approximately 7/16-inch long (including the plate thickness) and is approximately 5/32-inch in width. The shank of each tooth is formed into a slightly concave shape and is twisted along the length of the tooth shank so that the end of the tooth is rotated to approximately 42 degrees with respect to the plate width. Connector plates are available in one-inch increments of width and in 1-1/4-inch increments of length.

### **TEST AND RESULTS**

The tests and results below are in accordance with both the **Wisconsin Uniform Dwelling Code**, and the **Wisconsin Code** for commercial and multi-family dwellings:

Tests were conducted to evaluate the lateral resistance design values of the Model 20, TW18 and TW16 metal plate connectors for various species (Douglas Fir, Hem Fir, Southern Yellow Pine and Spruce-Pine-Fir), in accordance with the ANSI/TPI-95. The Gross Area Method described in ANSI/TPI-95 was used to determine the plate holding values.

#### **Model 20 and TW18 Metal Connector Plate Design Values**

ALLOWABLE LOAD IN POUNDS PER SQUARE INCH OF PLATE CONTACT AREA																				
PLATE TYPE	DOUGLAS FIR				HEM FIR				SOUTHERN YELLOW PINE				SPRUCE-PINE-FIR <sub>1</sub>				Roller Press Design Value Adjustment Factor Q <sub>R</sub>			
	Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate				Douglas Fir		Southern Pine	
	AA	EA	AE	EE	AA	EA	AE	EE	AA	EA	AE	EE	AA	EA	AE	EE	16-in	20-in	16-in	20-in
	186	169	143	133	150	125	117	114	195	172	181	154	187	131	126	116	0.92	0.99	0.76	0.94
Model 20 & TW18	SPRUCE-PINE-FIR <sub>2</sub>				TIMBER STRAND				WESTERN WOODS											
	Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate											
	AA	EA	AE	EE	AA	EA	AE	EE	AA	EA	AE	EE								
	189	163	159	142	198	178	181	166	130	116	105	101								

Note: 1. Oven dry specific gravity 0.42.

2. Oven dry specific gravity 0.50.

<b>SHEAR LOAD EFFECTIVENESS RATIOS</b>		
TYPE OF PLATE	DIRECTION OF LOAD WITH RESPECT TO LENGTH OF PLATE	SHEAR RESISTANCE EFFECTIVENESS RATIO (PERCENT)
<b>Model 20 &amp; TW18</b>	0°	59%
	30°	64%
	60°	73%
	90°	43%
	120°	47%
	150°	44%

TENSION LOAD EFFECTIVENESS RATIOS		
TYPE OF PLATE	EFFECTIVENESS RATIO (in percent)	
	Parallel	Perpendicular
<b>Model 20 &amp; TW18</b>	48%	54%

**TW16 Metal Connector Plate Design Values**

ALLOWABLE LOAD IN POUNDS PER SQUARE INCH OF PLATE CONTACT AREA																				
PLATE TYPE	DOUGLAS FIR				HEM FIR				SOUTHERN YELLOW PINE				SPRUCE-PINE-FIR <sub>1</sub>				Roller Press Design Value Adjustment Factor Q <sub>R</sub>			
	Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate				Douglas Fir		Southern Pine	
	AA	EA	AE	EE	AA	EA	AE	EE	AA	EA	AE	EE	AA	EA	AE	EE	16-in	20-in	16-in	20-in
	157	161	111	132	108	120	86	99	156	159	140	131	112	110	81	93	1.02	0.89	0.80	0.89
TW16	TIMBER STRAND				WESTERN WOODS				SPRUCE-PINE-FIR <sub>2</sub>											
	Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate				Direction of Grain and Load with Respect to Length of Plate											
	AA	EA	AE	EE	AA	EA	AE	EE	AA	EA	AE	EE								
	181	172	132	153	101	114	79	50	136	150	119	117								

Note: 1. Oven dry specific gravity 0.42.

2. Oven dry specific gravity 0.50

SHEAR LOAD EFFECTIVENESS RATIOS		
TYPE OF PLATE	DIRECTION OF LOAD WITH RESPECT TO LENGTH OF PLATE	SHEAR RESISTANCE EFFECTIVENESS RATIO (PERCENT)
<b>TW16</b>	0°	61%
	30°	61%
	60°	81%
	90°	61%
	120°	53%
	150°	44%

TENSION LOAD EFFECTIVENESS RATIOS		
TYPE OF PLATE	EFFECTIVENESS RATIO (in percent)	
	Parallel	Perpendicular
<b>TW16</b>	72%	43%

The lateral resistance values must be reduced by the percentage listed in TPI-95, Design Specifications for Metal Plate Connected Wood Trusses (section 5.11.1.3), at various joint locations and in accordance with good engineering practices as may be necessitated by minimum plate size and handling and shipping procedures.

**LIMITATIONS OF APPROVAL**

**GENERAL:** This approval is for the allowable design values of the metal connector plates and tension web only as specified in the manufacturer's product catalog. It is not an approval for a truss or joist or a construction design.

Allowable loads are based on Douglas Fir (DF), Spruce (S-P-F), Hem-Fir, and Southern Yellow Pine (SYP) wood. The allowable load for other wood species must be adjusted according to the to the 1991 Edition of the National Design specification for Wood Construction.

The evaluation of the use of Model 20 (20 gauge), TW18 (18 gauge) and TW16 (16 gauge), metal connector plates with pressure or fire retardant treated lumber is beyond the scope of this approval.

Truss framing members shall be held in jigs during installation. The plates are inserted under pressure from a hydraulic press or roller press.

The metal connector plates and tension web must be installed according to the manufacturer's installation requirements.

The limitations below are in accordance with both the **Wisconsin Uniform Dwelling Code**, and the **Wisconsin Code** for commercial and multi-family dwellings or as noted:

This approval is for the allowable design values of the connector plates only and not an approval for a truss or joist or a construction design. See **TESTS AND RESULTS** section above for the allowable design values.

The connector plates have been designed in accordance with the procedures established by the Truss Plate Institute and the design specifications for light metal plate connected trusses. Truss designs must be manufactured according to the specifications of the T.P.I.

The connector plates may be used to construct trusses in accordance with **ss. Comm 21.22 (2), 21.28 (5)** of the **Wisconsin Uniform Dwelling Code**, and **s. IBC 2306.1** of the **Wisconsin Amended IBC 2000 Code**.

**IDENTIFICATION:** with the manufacturer's name and as follows:

Embossed with the symbols: "TW20" stamped into the parent metal,  
"TW18" stamped into the parent metal,  
"TW16" stamped into the parent metal.

#### **INFORMATION REQUIRED ON PLANS SUBMITTED**

#### **TRUSS PLAN SUBMITTAL REQUIREMENTS:**

The approval number as well as the following information must be made a part of all truss plan submittals so that unnecessary delays will not result because of the lack of proper information.

1. Acceptable Unit Stresses. The allowable unit stresses published in the National Design Specifications For Wood Construction, including Design Values for Wood Construction, supplement to the Edition of the National Design Specification for Wood Construction, as recommended by the National Forest Products Association and its Supplement, shall be used to determine allowable unit stresses.
2. An increase in allowable bending stress due to repetitive member use is acceptable as listed in NDS Table 1 Supplement.
3. Moment coefficients used in design of top or bottom chord members shall be based on the assumption of no fixity at member end or joints due to plate connectors. Moment coefficients listed in ANSI/TPI-95 with appropriate panel length adjustment factors are to be used in the design of the trusses.
4. The cumulative effects of short-time loads, such as snow, shall be considered in determining the duration of the load. For snow load, no greater duration of load factor than 1.15 shall be used.
5. The metal plate connector must be properly identified on the plans. The gauge of metal plate and its design capacity (in pounds per nail or pounds per square inch) must be shown on the plans. Light gauge perforated metal plate connectors shall be permanently identified with regard to their gauge and manufacturer. If a manufacturer's code is used to identify the plates, the code shall be explained on the plans. The design and use of metal plate connectors shall be in accordance with the requirements of **s. IBC 2306.1**.
6. Drawings must be provided for all joints and splices (duplication of identical joints is not necessary). The drawings must clearly indicate the contributory number of nails or square inches of plate area required on each member of each joint.
7. A stress diagram (to scale or a function of "L") must be shown on the plans. An acceptable alternate would be to provide calculations using other methods of determining axial loads. Calculations may be placed on computer output sheets only if computer programs are provided with adequate explanation on request to the satisfaction of the department.
8. Calculations must be provided which analyze the combined effects of axial loads and bending moments on top and bottom cord members.

9. A framing plan must accompany the truss plans when several different trusses, bearing conditions and elevation changes occur.
10. All wood trusses shall be securely fastened to the supports and each truss shall be secured in position in accordance with National Design Specifications, Appendix A, Section A-10.
11. A title block must be provided on all submittals indicating the name of the owner, exact address of building and location of building. If there are several building on a lot, the trusses must be properly identified for location (this is not necessary for identical trusses).
12. All truss plans for buildings over 50,000 cubic feet in volume must be sealed or stamped and signed by an architect or professional engineer registered in Wisconsin. The intent is to have each sheet stamped, signed and dated by the engineer or architect responsible for the trusses. If the building designer is different than the truss designer the truss plans shall be submitted by the building designer with their initials, and a statement on the truss plans that, they are acceptable.
13. Wood trusses shall be designed and constructed in accordance with the National Design Standard For Metal Plate Connected Wood Truss Construction published by the Truss Plate Institute (ANSI/TPI-95) with listed exceptions as outlined above and stated in **s. IBC 2306.1**.
14. An examination fee per **s. Comm 2.31** may be required for each building submittal.

Any other information required by **s. Comm 61.31** shall also be submitted.

This approval will be valid through December 31, 2009, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The product approval is applicable to projects approved under the current edition of the applicable codes. This approval may be void for project approvals made under future applicable editions. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

#### **DISCLAIMER**

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:

Approval Date: March 22, 2005 By: \_\_\_\_\_

Lee E. Finley, Jr.  
Product & Material Review  
Integrated Services Bureau